TENNESSEE CONSOLIDATED RETIREMENT SYSTEM

Experience Study
July 1, 2016 – June 30, 2020

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Experience Study Purpose

- Statutory requirement at least every 6 years
  TCA Section 8-34-503(b)

- Verify accuracy of valuation assumptions

- Modify assumptions if needed

Actuarial Assumption Overview

- Plan costs are determined by actual experience of the plan

> Benefits paid

> \+ Expenses

> \- Investment return

> Plan Costs

- Role of actuarial assumptions
  - present value determination of estimated future plan costs
  - timing of contributions to fund estimated future plan costs

Actuarial Assumption Overview

- Demographic Assumptions
  - Post-retirement mortality
  - Pre-retirement mortality
  - Rate of disability
  - Turnover/Withdrawal
  - Retirement

- Economic Assumptions
  - Inflation
  - Cost of living adjustments
  - Investment return/Discount rate
  - Compensation increases
  - Social Security wage base growth

Experience Study Process

- Data Collection
  - Provided by TCRS
  - 4-year period ending June 30, 2020

- Expected Incidence/Exposure/Assumed Rate
  - Apply existing assumptions
  - Determine expected outcomes

- Actual Incidence
  - Compare to actual outcomes
  - Analyze and adjust if appropriate reflection of the future

Data Groupings

- Teachers Group
  - Teachers
  - UT-TIAA with guarantees
  - Local Teachers
  - "Aged" Teachers
  - Group III

- General State Group
  - General State
  - Political Subdivisions
  - Group II

System Overview – Legacy Plans
(as of June 30, 2020)

- Defined Benefit System
  - State employees, higher education and K-12 teachers hired prior to July 1, 2014
  - 561 local governments (participation is optional and costs are valued individually)

- Demographic Data (including local governments)
  - 172,000 Active Participants
  - 166,000 Retired Participants ($2.8 Billion in annual payments)

- Market Value of Assets -- $52.6 Billion

System Overview – Hybrid Plans
(as of June 30, 2020)

- Defined Benefit System
  - State employees, higher education and K-12 teachers hired on or after July 1, 2014
  - 50 local governments (participation is optional and costs are valued individually)

- Demographic Data (excluding local governments)
  - 51,000 Active Participants
  - 63 Retired Participants

- Market Value of Assets -- $709 Million

Demographic Assumption Principles

- Match experience

- Credibility

- Conform to industry standards

- Continuity

- Liability weighted results
  – Results not just based on <u>number</u> of participants
  – Results <u>weighted</u> by benefit liability

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Post-retirement Mortality

- Observations (2020 TCRS Experience vs. 2016 assumption)
  - Teachers
    - Male mortality – 2% more deaths than 2016 assumption
    - Female mortality – 5% less deaths than 2016 assumption
    - **Overall Average – 2% less deaths than 2016 assumption**

  - General State/Political Subdivisions
    - Male mortality – 5% more deaths than 2016 assumption
    - Female mortality – 1% less deaths than 2016 assumption
    - **Overall Average – 2% more deaths than 2016 assumption**

Post-retirement Mortality

- 2020 TCRS Experience vs. Industry Standard Mortality
  - Teachers
    - Male mortality – 119% of Pub-2010 Teacher Below Median
    - Female mortality – 118% of Pub-2010 Teacher Below Median
    - **Overall Average – 118% of Pub-2010 Teacher Below Median**

  - General State/Political Subdivisions
    - Male mortality – 106% of Pub-2010 General Below Median
    - Female mortality – 114% of Pub-2010 General Below Median
    - **Overall Average – 110% of Pub-2010 General Below Median**

Post-retirement Mortality

- Current Assumption
  - Base Table: RP-2006* Annuitants adjusted for 2012-2016 TCRS Experience
    - Teachers – RP-2006* White Collar (111% - Male; 98% - Female)
    - General State/PoliSubs – RP-2006* Blue Collar (102% - Male; 97% - Female)
  - Improvement Scale: MP-2020 (most current available each year)
  - Projection Period:
    - Legacy Plan – 6 years beyond each valuation date
    - Hybrid Plan – Full Generational

- Recommended Assumption
  - Base Table: Pub-2010 Annuitants adjusted for 2016-2020 TCRS Experience
    - Teachers – Teacher Below Median (119% - Male; 118% - Female)
    - General State/PoliSubs – General Below Median (106% - Male; 114% - Female)
  - Improvement Scale: MP-2020 (most current available each year)
  - Projection Period:
    - Legacy Plan – Full Generational
    - Hybrid Plan – Full Generational

* Previously called RP-2014 (the table was published in 2014 based on data with a mid-point year of 2006)

Post-retirement Mortality (Disabled Lives)

- Current Assumption (All groups)
  - 110% of standard IRS disabled mortality table
    (Sex-distinct disability mortality table per RR 96-7)

- Observations
  - 2020 study observed more deaths than expected
  - Other industry tables would expect fewer deaths
  - Relatively small amount of data to be credible

- Recommended Assumption (All groups)
  - No change to base rates (continue to monitor in future studies)
  - Apply full generational projection of improvements to be consistent with other mortality assumptions and industry standards

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▶ Pre-retirement Mortality

- Current Assumption
  - Base Table: RP-2006* Employees (Total dataset)
  - Improvement Scale: MP-2020 (most current available each year)
  - Projection Period:
    - Legacy Plan – 15 years beyond each valuation date
    - Hybrid Plan – Full Generational

- Recommended Assumption
  - Base Table: Pub-2010 Employees
    - Teachers – Teacher Employee
    - General State/PoliSubs – General Employee
  - Improvement Scale: MP-2020 (most current available each year)
  - Projection Period:
    - Legacy Plan – Full Generational
    - Hybrid Plan – Full Generational

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Rate of Disability

- Current assumption is based on 2004-2008 TCRS Experience

- Fewer disabilities occurred in 2012-2016 than in prior years

- Incidence of disability is so low that overall pension costs are not very sensitive to changes in disability rates

- Results for disability continue to be very inconsistent between study periods suggesting experience is less than fully credible

- Recommendation: maintain disability assumptions as-is and monitor again in 2024 to identify a more stable pattern

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▶ Turnover/Withdrawal and Retirement

- Current assumption is based on 2004-2008 TCRS Experience

  – Turnover has 3 sets of rates (1st year, 2nd year, and ultimate) to reflect the higher turnover rates that occur in the first two years of service

  – Retirement has a set of base rates plus additional increments in 1st year of eligibility and for retirees with 15+ years of service after age 60

- Reviewed all experience from 2008 to 2020

  – 12-year period included both lower and higher economic cycles

  – Turnover and retirement followed similar patterns to economy (employees generally work longer in lower economic cycles and are more likely to change jobs or retire in higher economic cycles)

Turnover/Withdrawal and Retirement

- Recommend adjusting current assumptions to partially reflect experience since 2008
  - Target more stable/credible assumptions over the long-term
  - Gradually adjust assumptions as new trends emerge rather than fully match each cycle/period in the short-term (which could end up being reversed in the next study)

- Recommended adjustments for Turnover/Withdrawal
  - **Teachers:** multiply 1st year rates by 90%
  - **General State:** multiply ultimate rates by 110%
  - **PoliSubs:** multiply 1st and 2nd year rates by 90%

Turnover/Withdrawal and Retirement

- Recommended adjustments for Retirement

  - Leave base rates unchanged

  - Update additional increment in 1st year of eligibility
    - **Teachers:** leave as is (current is 12.5%)
    - **General State:** 9.0% (current is 7.5%)
    - **PoliSubs:** 6.5% (current is 7.5%)

  - Update additional increment for retirees with 15+ years of service after age 60
    - **Teachers:** 7.0% (current is 8.0%)
    - **General State:** 3.0% (current is 2.0%)
    - **PoliSubs:** 3.0% (current is 2.0%)

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Inflation

- Component in all economic assumptions

- Current assumption is 2.5%

- Background
  - 15 year average   1.89%
  - 25 year average   2.14%
  - 30 year average   2.25%
  - 50 year average   3.83%
  - Horizon Survey*   2.23%

- Recommended assumption is 2.25%

* Survey of capital market assumptions (2021 edition) by Horizon Actuarial Services, LLC

Cost of Living Adjustments (COLA)

- Annual TCRS COLA limited to 3.0%

- Recommended long-term inflation assumption of 2.25% is an average (some years higher, some years lower)

- TCRS COLA will be less than the 3.0% cap when inflation is low but will not exceed 3.0% when inflation is high

- Long-term COLA average with cap will be less than the long-term assumed rate of inflation

- Inflation History (capped at 3.0% annually)
  - 15 year average   1.82% (uncapped = 1.89%)
  - 25 year average   2.04% (uncapped = 2.14%)
  - 30 year average   2.16% (uncapped = 2.25%)
  - 50 year average   2.46% (uncapped = 3.83%)

- Recommended assumption is 2.125% (0.125% reduction)

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TCRS Investment Return History

Fiscal Year	Rate of Return During Year	30-Year Average Annualized Rate of Return Through Given Year
2020-2021	25.6%	8.1%
2019-2020	4.9	7.5
2018-2019	7.5	7.7
2017-2018	8.2	8.0
2016-2017	11.4	7.8
2015-2016	2.8	7.7
2014-2015	3.3	8.5
2013-2014	16.7	9.3
2012-2013	9.9	8.6
2011-2012	5.6	9.4

TCRS Investment Policy

Asset Class	Long-term Target Allocation
Domestic Equity	31%
International Equity	14
Emerging Markets	4
Domestic Fixed Income	20
Private Equity – Traditional	10
Private Equity – Strategic Lending	10
Real Estate	10
Cash and Cash Equivalents	1
TOTAL	100%

Capital Market Projection

Horizon Survey	Real Rate of Return	Assumed Inflation	Total Rate of Return
20-Year Projection*	4.09%	2.25%	6.34%

* Based on 20-year capital market projections (2021 edition) published by Horizon Actuarial Services, LLC, which compiled information from 12 different investment organizations

Investment Return/Discount Rate

- Current assumption is 7.25%

- 30-year historical TCRS return = 7.99% (after adjusting for actual vs. assumed inflation)

- 20-year capital market projection = 6.34%

- Future time horizon of the actuarial valuation is longer than 20-years and should reflect a long-term expectation

- History may not be the best predictor of the future, but it provides a a good indicator of multiple economic cycles

▶Investment Return/Discount Rate

- Must decide how much to weight the shorter-term forward projection vs. the longer-term historical return
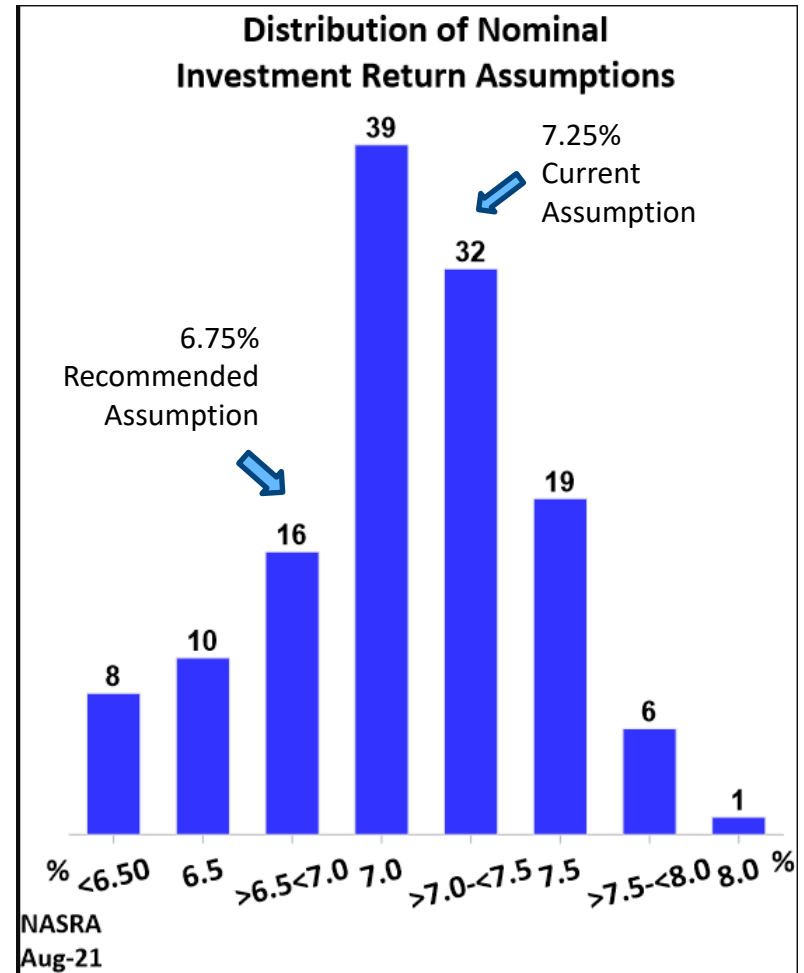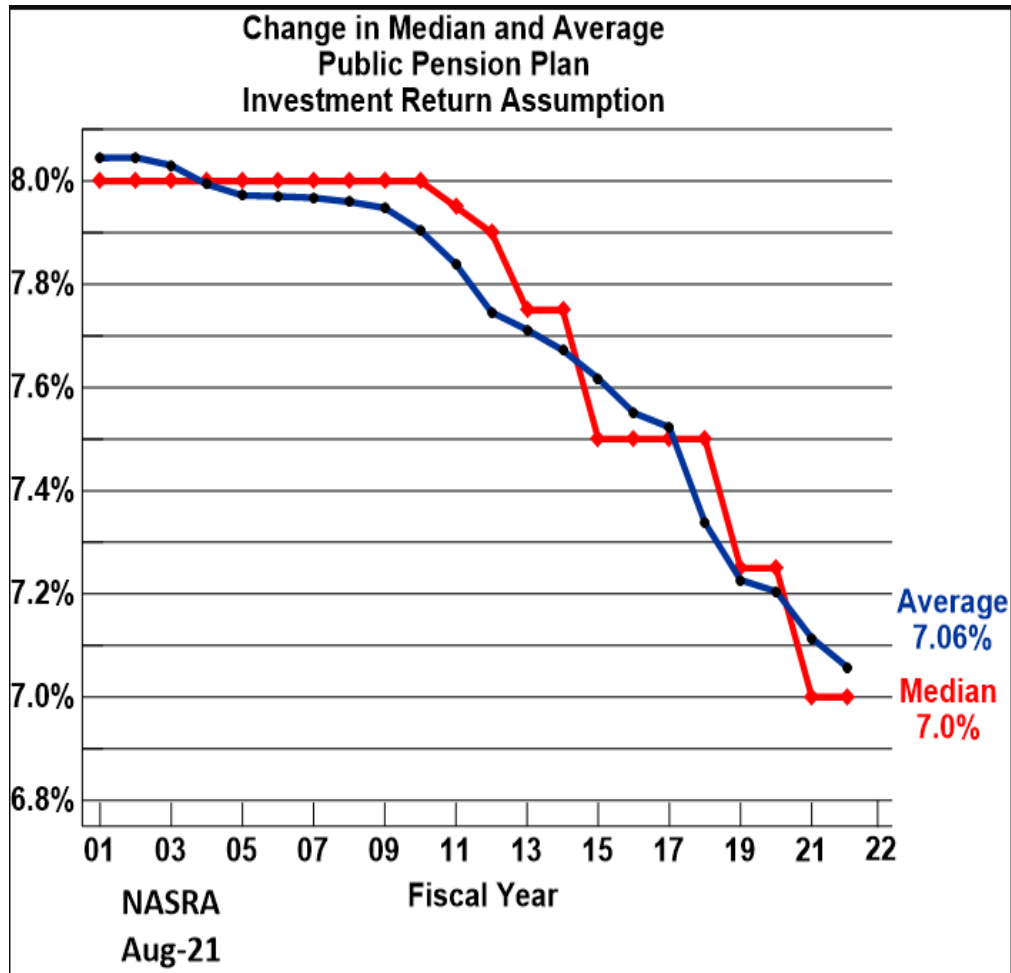
Potential Weightings		Weighted
Forward Projection	**Historical Return**	**Return**
0%	100%	7.99%
10%	90%	7.82%
20%	80%	7.66%
30%	70%	7.49%
40%	60%	7.33%
50%	50%	7.16% ⬅ Current Assumption: 7.25%
60%	40%	7.00%
70%	30%	6.83%
80%	20%	6.67% ⬅ Recommended Assumption: 6.75%
90%	10%	6.50%
100%	0%	6.34%

▶ Investment Return/Discount Rate

NASRA Survey of Investment Return Assumption for Public Pension Plans

Change in Median and Average Public Pension Plan Investment Return Assumption

Distribution of Nominal Investment Return Assumptions

Charts pulled from www.nasra.org

Investment Return/Discount Rate

- Recommended assumption is 6.75%
    - Lower end of reasonable range to reflect conservatism
    - Reflects lower inflation expectation
    - Consistent with recent industry trends of lowering expected return assumption (represents a 0.50% decrease)

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Compensation Increases

- Pattern of compensation change declines by age

- Related to inflation and market influences

- Components:
  – Inflation + Merit Increase + National Productivity Increase

- Current assumption:
  – 8.72% at age 20 graded to 3.44% at age 70 = approx. 4.0% weighted average
  – Inflation (2.5%) + Merit Increase (1.0%) + National Productivity Increase (0.5%) = 4.0% Total Average Increase

Compensation Increases

- Observations between 2016 and 2020
  - Average raises for all groups during the period were approx. 4.8% (inflation during the period was 2.1%)
  - Potentially overstated due to one-time compensation policies and adjustments
  - Continued market pressure limiting compensation increases
- Recommended assumption:
  - Leave as-is: represents 0.25% increase in Merit component, since recommending 0.25% decrease to Inflation
  - Inflation (2.25%) + Merit Increase (1.25%) + National Productivity Increase (0.5%) = 4.0% Total Average Increase

Social Security Wage Base Growth (Legacy Plan Only)

- Related to inflation

- Include national productivity increase

- Generally 0.5% greater than inflation

- Current assumption: 3.0%

- Recommended assumption: 2.75%
  - Inflation (2.25%) + National Productivity Increase (0.5%)

TCRS Option Factors

- Factors related to survivorship options at retirement, early retirement reduction, actuarial equivalence, etc.

- Update to be performed based on new assumptions

- Impacted by discount rate, mortality and COLA

- Applicable to Legacy Plan and Hybrid Plan